

Notice of Allowability

Application No.

10/697,052

Examiner

Peter Coughlan

Applicant(s)

BROWN ET AL.

Art Unit

2129

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 1/22/2006.
2. ☒ The allowed claim(s) is/are 1-10, 12-13, 16-17, 22-24.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

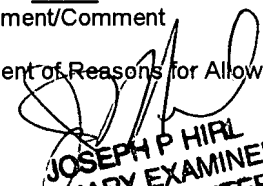
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material

5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413),
Paper No./Mail Date _____
7. ☒ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____


JOSEPH P. HIRL
PRIMARY EXAMINER
TECHNOLOGY CENTER 2100

Examiner's Amendments / Reasons For Allowance

1. An Examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the issue fee.

In the Claims

2. In the amended claims, claim 1 is labeled 'original' when in fact it has been amended. In claim 1 'Original' should be replaced with 'Currently Amended.'

3. Authorization for this Examiner's Amendment was given in a telephone interview with Mr. Randy W. Lacasse (Reg. No. 34368) on 5/8/2007.

4. Claims 1-10, 12-13, 16-17, and 22-24 are allowed.

5. The following is an Examiner's Statement for reasons for allowance:

The cited art taken alone or in combination fails to teach the claimed invention of a computer based method to perform query optimization by automatically finding and exploiting hidden, fuzzy algebraic constraints in a database, said method comprising the steps of:

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(a) constructing one or more candidates of form $C = (a_1, a_2, P, \oplus)$, wherein a_1 and a_2 are numerical attributes associated with column values of data in said database, P is a pairing rule, and \oplus is any of the following algebraic operators: $+$, $-$, \times , or $/$;

(b) constructing, for each candidate identified in (a), an algebraic constraint $AC = (a_1, a_2, P, \oplus, I_1, \dots, I_k)$ by applying a segmentation technique, where I_1, \dots, I_k is a set of disjoint intervals and $k \geq 1$, said step of constructing algebraic constraint further comprising the steps of :

constructing a sample set W_C of an induced set Ω_C , wherein P is a join predicate between tables R and S and $\Omega_C = \{ ra_1 \oplus ra_2 : r \in R \}$ when the pairing rule P is a trivial rule \emptyset_R and

$\Omega_C = \{ ra_1 \oplus sa_2 : r \in R, s \in S, \text{ and } (r, s) \text{ satisfies } P \}$;

sorting n data points in said sampled set W_C in increasing order as $x_1 \leq x_2 \leq \dots \leq x_n$ and constructing a set of disjoint intervals I_1, \dots, I_k such that data in sample W_C falls within one of said disjoint intervals, wherein segmentation for constructing said set of disjoint intervals is specified via a vector of indices $(i(1), i(2), \dots, i(k))$ and the j^{th} interval is given by

$I_j = [x_{i(j-1)+1}, x_{i(j)}]$ and length of I_j , denoted by L_j , is given by

$L_j = x_{i(j)} - x_{i(j-1)+1}$; and

wherein the function for optimizing cost associated with segmentation is

$$c(S) = wk + (1-w) \left[\frac{1}{\Delta} \sum_{j=1}^k L_j \right]$$

with w being a fixed weight between 0 and 1 and a segmentation that minimizes c is defined by placing adjacent points x_i and x_{i+1} in the same segment if and only if $x_{i+1} - x_i < d^*$, where $d^* = \Delta(w/(1-W))$, and wherein said constructed algebraic constraints are use in query optimization.

Applicant further discloses that the sole purpose of this invention is where 'new access paths lead to substantial speedups in query processing.'

6. The closest prior art teaches ('Interactive data analysis: The control Project': Hellerstein) Hellerstein anticipates (a) constructing one or more candidates of form $C = (a_1, a_2, P, \oplus)$, wherein a_1 and a_2 are numerical attributes associated with column values of data in said database, P is a pairing rule, and \oplus is any of the following algebraic operators: $+$, $-$, $*$, or $/$ (Hellerstein, p55, C2:22-49; Constructing or identifying candidates among multiple databases of applicant is equivalent to 'join' of Hellerstein.); (b) constructing, for each candidate identified in (a), an algebraic constraint $AC = (a_1, a_2, P, \oplus, I_1, \dots, I_k)$ by applying any of, or a combination of the following techniques to a sample of column values: statistical histogramming, segmentation, or clustering, where I_1, \dots, I_k is a set of disjoint intervals and $k \geq 1$ (Hellerstein, p53, C1:4 through C2:7; Hellerstein illustrates a set of disjoint intervals with clustering.), and wherein said constructed algebraic constraints are used in query optimization. (Hellerstein, p52, C1:34-47)

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7. The reference fails to teach constructing, for each candidate identified in (a), an algebraic constraint $AC = (a_1, a_2, P, \oplus, I_1, \dots, I_k)$ by applying a segmentation technique, where I_1, \dots, I_k is a set of disjoint intervals and $k \geq 1$, said step of constructing algebraic constraint further comprising the steps of :

constructing a sample set W_C of an induced set Ω_C , wherein P is a join predicate between tables R and S and $\Omega_C = \{ ra_1 \oplus ra_2 : r \in R \}$ when the pairing rule P is a trivial rule \emptyset_R and

$\Omega_C = \{ ra_1 \oplus sa_2 : r \in R, s \in S, \text{ and } (r, s) \text{ satisfies } P \}$;

sorting n data points in said sampled set W_C in increasing order as $x_1 \leq x_2 \leq \dots \leq x_n$ and constructing a set of disjoint intervals I_1, \dots, I_k such that data in sample W_C falls within one of said disjoint intervals, wherein segmentation for constructing said set of disjoint intervals is specified via a vector of indices $(i(1), i(2), \dots, i(k))$ and the j^{th} interval is given by

$I_j = [x_{i(j-1)+1}, x_{i(j)}]$ and length of I_j , denoted by L_j , is given by

$L_j = x_{i(j)} - x_{i(j-1)+1}$; and

wherein the function for optimizing cost associated with segmentation is

$$c(S) = wk + (1 - w) \left[\frac{1}{\Delta} \sum_{j=1}^k L_j \right]$$

with w being a fixed weight between 0 and 1 and a segmentation that minimizes c is defined by placing adjacent points x_i and x_{i+1} in the same

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segment if and only if $x_{l-1} - x_l < d^*$, where $d^* = \Delta(w/(1-W))$, and wherein said constructed algebraic constraints are use in query optimization.

Any comments considering this communication or earlier communications from the Examiner should be directed to Peter Coughlan whose telephone number is (571) 272-5990, Monday through Friday from 7:15 a.m. to 3:45 p.m. or contact the Supervisor Mr. David Vincent at (571) 272-3080.



Peter Coughlan

5/8/2007



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